Unit 6: Developing Skills in Joining Materials Using Welding

Unit reference number: K/601/0096

QCF level: 1

Credit value: 3

Guided learning hours: 30

Unit aim

This unit will enable learners to develop manual skills when working with welding equipment so that they can apply them to joining metals with joints which have recognised configurations and acceptable levels of accuracy and quality. This unit provides some of the knowledge, understanding and skills for the Level 1 Performing Engineering Operations NOS Unit 15: Using Manual Arc Welding Equipment, NOS Unit 16: Using TIG Welding Equipment, NOS Unit 17: Using Manual MIG or MAG Welding Equipment and Unit 18: Using Manual Oxy-fuel Gas Welding Equipment.

Unit introduction

In this unit learners will be introduced to the practical skills needed to weld metals. They will explore the need to understand what they are going to carry out and prepare the work area correctly. Using appropriate edge preparation and welding equipment learners will produce simple fabrications which meet given specifications.

Learners will consider the importance of working safely in an engineering workshop and the need to check that tools and equipment are in a safe and useable condition at all times. They will understand the special requirements relating to the use of welding equipment, the handling of hot materials and the personal protection of themselves and other people.

Cleaning down work areas on completion of activities and the return of tools and equipment to safe storage are considered in the context of good housekeeping, efficient working and health and safety.

This unit will help learners to appreciate the importance of following given instructions when carrying out activities and to recognise the problems which may occur when working with welding equipment.

Essential resources

It would be extremely useful if learners had access to a range of equipment commonly used in engineering. It may be possible to arrange a visit to an engineering company to extend learner awareness of the range of resources used in engineering.

A typical centre engineering workshop should be equipped with the basic requirements of this unit including a range of welding process equipment, for example oxy fuel-gas, manual metal arc, gas-shielded arc. All supporting auxiliary equipment should also be available together with appropriate safety equipment.

Workshops should be staffed appropriately to ensure health and safety requirements are met. Technician support may be required during practical work.

Learning outcomes, assessment criteria and unit amplification

To pass this unit, the learner needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria determine the standard required to achieve the unit.

Learning outcomes		Assessment criteria		Unit amplification
1	Be able to prepare a work area in readiness for welding operations	1.1	Confirm with a supervisor what has to be done before welding operations are carried out safely	□ *Before starting work*: understand the task eg what needs to be carried out, order of operations, tools and equipment, quality checks; personal protection eg eye protection, lens filters, hair protection, footwear, use of barrier cream, removal of loose clothing and jewellery; regulations and safety procedures eg handling hot material, fume extraction, protective screens, initiating arc/flame; maintenance of access eg clear walkways, emergency exits; understand the need for good housekeeping eg cleanliness of work area, eliminating potential hazards; understand what might go wrong eg materials of the wrong size, an equipment fault develops, consumables/gases run out, finished welds not to standard; confirm proposed actions with a supervisor
		1.2	Prepare a work area ready for the welding of materials	□ *Work area preparation*: select appropriate welding equipment eg manual metal arc, oxy fuel-gas, TIG, MIG/MAG; obtain materials to be welded eg carbon steel, stainless steel, aluminium; select appropriate consumables eg filler wire, filler rod, electrode; select hand tools eg clamps, vice, hammers, rule, square, wire brush; obtain correct personal protective equipment eg eye protection, hair protection, overalls, safety footwear; identify procedures for equipment start up/close down in both normal and emergency situations
		1.3	Check that materials are correct and tools and equipment are safe to use	□ *Check that materials are correct and equipment is safe to use*: check materials to ensure right type and size; check materials are free from excessive contamination eg rust, oil, grease, dirt; check condition and correct assembly of equipment eg power cables, earth returns, gas hoses, regulators, safety valves, torch/electrode holders, gas leaks, lens filters, clamps

Learning outcomes		Assessment criteria		Unit amplification
2	Be able to produce welded joints to the required standard	2.1	Use appropriate equipment to safely weld materials together	□ *Use equipment to weld materials together safely*: welded joints eg fillet lap, tee fillet, close corner, butt; welding position eg flat hand down, horizontal, vertical; 100 mm minimum weld length; forms of material eg plate, section, tube; run welds eg single, multi, stop, restart; edge preparation eg flat, square, bevelled; set up and restrain materials eg position, alignment, gapping, clamps, fixtures; starting the weld eg striking, initiating, torch lighting, adjust/control arc/flame; tack weld; controlling the weld eg speed, direction, angle, blending stops/starts/tacks, distortion, finished appearance
		2.2	Check that the welded joints meet the standards required	□ *Check that welded joints meet the required standards*: dimensional checks eg positional accuracy, size, profile of weld, distortion; visual checks eg uniformity, alignment, correct fusion, fillet of appropriate size, porosity, slag inclusions, parent metal substantially free from arcing or chipping marks
		2.3	Follow correct procedures to close down and safely store welding equipment	□ *Follow correct procedures to close down and store welding equipment safely*: closing down equipment eg isolation of electrical supplies, extinguishing the welding flame, turning off gas cylinders/supply; storing equipment safely eg cables, gas hoses, cylinders, welding sets, filler wires, electrodes, hand tools; returning and storing safety equipment; good housekeeping eg cleaning down, shutting off fume extraction, return of tools and equipment into safe storage

Information for tutors

Delivery

This unit is essentially practical and learners would benefit from practising their skills before being assessed. Learners should think about the processes needed and actions to be taken to prepare their workplace and then weld materials into basic fabrications. Learners should have opportunities to talk about what they are going to carry out and how they propose to overcome problems which may occur whilst they are assembling components. It is important that they understand the safety aspects of working with welding equipment and the measures which must be taken in order to minimise risk. They should also be fully aware of what to do in the case of an emergency.

Outline learning plan

The outline learning plan has been included in this unit as guidance.

Topic and suggested assignments/activities
Confirm with a supervisor what has to be done before welding operations are carried out safely Tutor-led unit introduction covering content, method of working and assessment. Tutor-led overview of the welding skills learners will develop. Tutor-led introduction about how engineers plan the manufacture of basic fabricated structures. Tutor-led discussion about PPE, where and when it is necessary and how it works. Tutor-led discussion about the need to confirm proposed activities with a supervisor. Small-group activity to plan the production of a simple fabricated component.
Prepare a work area ready for the welding of materials Whole-class, tutor-led discussion about the need to prepare work areas – present examples of poor and good preparation. Paired activity to identify hazards/bad practices in workshops – presented as images with a checklist to complete.
Check that materials are correct and tools and equipment are safe to use Whole-class, tutor-led discussion about why welding equipment and materials should be checked before use. Tutor presents a small range of examples which show the consequences of working with equipment and materials that are not fit for purpose. Small-group activity to identify, from images, unsafe welding practices.
Use appropriate equipment to safely weld materials together Tutor demonstration of how to use the equipment learners will be working with. Individual activities to develop welding skills. Simple edge preparation and joint welding using available equipment (oxy-gas and/or electric arc).

Topic and suggested assignments/activities
Check that the welded joints meet the required standards Whole-class, tutor-led discussion about why welded joints need to be checked for accuracy, distortion and general quality. Paired activity to check the quality of pre-prepared joints and those that learners have produced.
Follow correct procedures to close down and store welding equipment safely Tutor-led discussion about the need for 'good housekeeping' in engineering workshops.
Assessment activity – prepare a work area and produce welded joints Individual activity: set up welding equipment, edge prepare materials, weld joints, carry out checks, close down and put away. The activity should address the unit content and six assessment criteria.
Seek and respond to guidance from their tutor Tutors should encourage learners to have a dialogue with them. This could be prompted by tutors asking learners to explain what they are doing, why they are doing it and how they are able to work safely. This does not require a formal allocation of time and should occur during delivery and assessment of the unit.

Assessment

The centre will devise and mark the assessment for this unit.

Learners must meet all assessment criteria to pass the unit.

Learners will benefit from access to a range of assessment opportunities. Examples might include observed practice, recorded explanations, checklists and annotated photographic records. Entries within a logbook and weld inspection reports, both validated by the tutor, are also appropriate methods for recording achievement. Competence in practical activities should be evidenced through witness testimonies or observation records signed by the tutor.

Suggested resources

Books

Boyce et al – *Engineering Level 1 Foundation Diploma* (Edexcel/Pearson, 2008) ISBN 9780435756253

Galvery – *Welding Essentials: Question and Answers* (Industrial Press, 2002) ISBN 9780831131234

Timings R L – *Basic Manufacturing* (Newnes, 1998) ISBN 9780750659901

Waters F – *Fundamentals of Manufacturing for Engineers* (UCL Press, 1996) ISBN 9781857283389

Tutor resource disks

Boyce et al – *Engineering Level 1 Foundation Diploma* (Edexcel/Pearson, 2008) ISBN 9780435756260

Videos

The Video Skill – *Guide to Gas Welding* (1991)

Websites

www.diywelding.co.uk

www.hse.gov.uk

www.mig-welding.co.uk/tutorial.htm

www.twi.co.uk